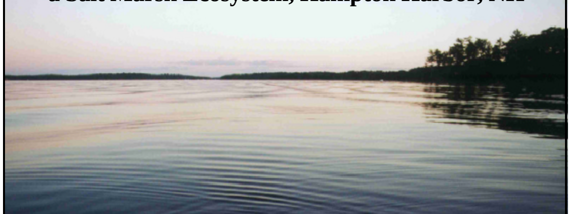
Examination of Inter-Tidal Groundwater Discharge in a Salt Marsh Ecosystem, Hampton Harbor, NH



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Background: Methodology

- GIS analysis of TIR, coupled with field investigations can be used to assess the flux of coastal GW discharge.
- This flux, combined with water quality data, can be used to estimate nutrient loading
- TIR is ideal for locating specific concentrated discharge areas symptomatic of complex hydrogeology.

Background: Methodology

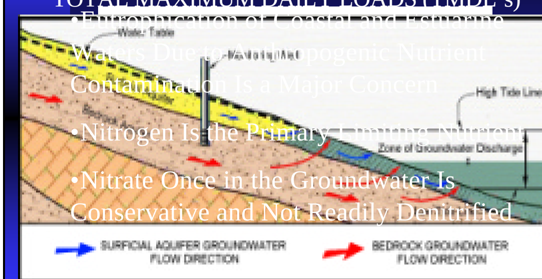
Background: Coastal Groundwater

TOTAL MAXIMUM DAILY LOADS (TMDL's)

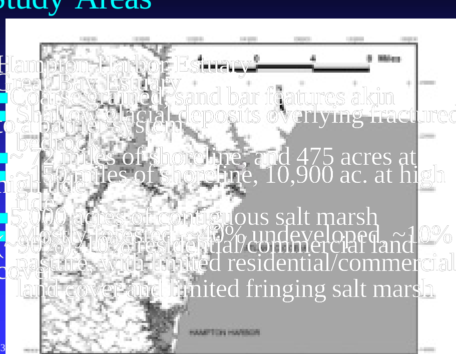
•Eutrophication of Coastal and Estuarine Waters Due to Anthropogenic Nutrient Contamination Is a Major Concern

•Nitrogen Is the Primary Limiting Nutrient

•Nitrate Once in the Groundwater Is Conservative and Not Readily Denitrified



Study Areas



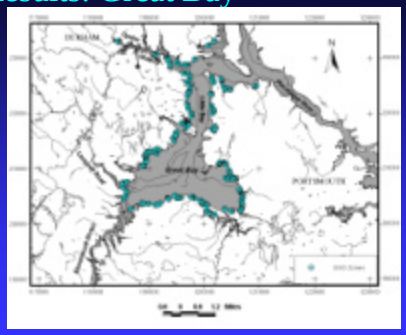
Hampton Harbor Estuary
- Coarse grained, sand bar features akin to a barrier system
- ~ 72 miles of shoreline, and 475 acres at high tide
- 5,000 acres of contiguous salt marsh
- (~90%), 10% residential/commercial land cover

Great Bay Estuary
- Shallow glacial deposits overlying fractured bedrock
- ~150 miles of shoreline, 10,900 ac. at high tide
- Mostly forested, ~40% undeveloped, ~10% pasture, with limited residential/commercial land cover and limited fringing salt marsh

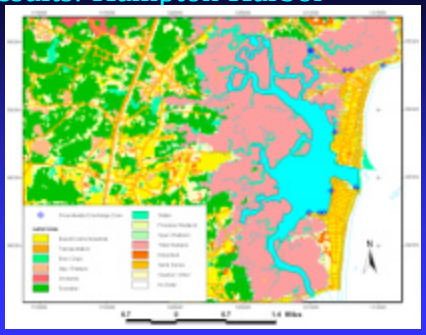
Site Characterization

- TIR Survey Flown
- TIR Imagery Analyzed for Groundwater Signatures
- Field Characterization and Water Quality Analyses
- Infiltration Rates

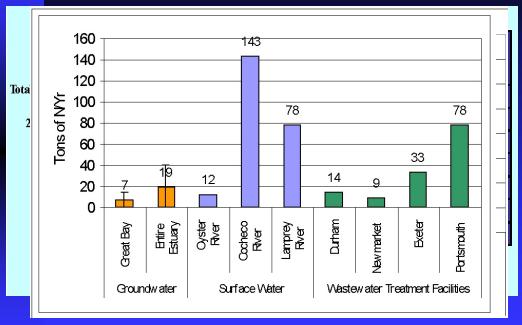
Results: Great Bay



Results: Hampton Harbor



Results: Great Bay



Future Implications

- •Rockingham county grew ~13% from 1990 to 2000 many towns growing 20-25%.
- •Areas surrounding the bay are 38% undeveloped
- •An increase in groundwater nitrate concentrations of three times (~3 mg N/L) would result in an annual loading of about 68 tons N.
- •Studies have reported increases of groundwater nitrate concentrations of 0.22 mg N/ L per year over 8-years, with concentrations having increased to an average of 3.3 mg N/L (Flipse et al, 1984)
- •These rates did not include loading from septic systems but rather primarily from the household use of fertilizers.

Conclusion

- Land Cover and Hydrogeology are instrumental in Coastal Groundwater Discharge
- TIR showed lack of intertidal groundwater discharge (IGD) within salt marsh
- GDZ limited to coarse sands and gravels, barrier dunes, and where development is present.
- Low surface K indicated areas of no localized groundwater recharge
- Land Use/Land Cover showed a nearly complete correlation between the salt marsh, residential/ commercial land cover classification, and IGD.

Conclusion

- This suggests that in areas with large fringing salt marsh, that intertidal groundwater discharge may be extremely limited and rather discharging elsewhere, presumably at depth as submarine groundwater discharge
- TIR is an effective affordable alternative to conventional groundwater mapping

Acknowledgements

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